ON THE APPLICATION OF MANGEL WURZEL AND POTATOES TO THE MANUFACTURE OF SUGAR AND SPIRITS.*

The work before us contains the latest compilation of French discoveries and improvements in this interesting manufacture, and some of the details have been already embodied in the last English editions of works on the art of distillation; much, however, that is peculiarly important to the agricultural interest has not yet been presented to its notice, either in review or translation. To these points I am chiefly desirous to draw public attention.

In the first vol. of the Edinburgh Agricultural Journal, may be seen some valuable details of the cost and profits of the production of beet-root sugar in France, together with the encouraging facts (given in evidence by M. Dubrunfaut before the committee for inquiring into the state of French manufactures and commerce,) that one half the sugar now used in France is home made, and that 4920 tons were manufactured there from the beet-root (mangel wurzel) in 1828. There is no reason why we should continue insensible to such a successful example of profitably varying the shape of our produce, in markets exhibiting the height of competition in corn, cattle, wool and potatoes.

Since Dr. Lettsom† introduced this admirable root from Germany, in 1776, British industry and ingenuity have only rendered it available in the feeding of cattle; while our scientific neighbours have made it subservient also to the production of two valuable commercial articles, sugar and spirit. M. Dubrunfaut's work is devoted to the consideration of the various profitable sources of the latter commodity, and beet-root stands high on the list, although affording the distillery nothing but the refuse of the sugar bakery.

"Beet-root sugar is liable, like all other vegetable products, to the casualities of cultivation. Every year is not equally favourable to its production, but an intelligent and scientific manufacturer always finds means to retrieve his difficulties and avoid loss. Thus for example, in an unfavourable year, the sugar maker whose expenses would scarcely be repaid by the small quantity of marketable sugar he could extract from the plant, has a valuable resource in distillation.

"In all cases, the opportunity of distilling spirit from the beet is a circumstance favourable to the cultivator, and we think it may be useful to develope, in detail, the best method of proceeding.

"The choice of the beet-root, whether we propose to obtain sugar or spirit, is not of less consequence in one case than in the other. There is a crowd of varieties distinguished by the colour of their rind, and of their flesh. The kinds preferred are the white, the yellow, and those that are white within, and red without. Whatever be the colour of the roots, it is essential to choose an appropriate soil, to manure it well, and to avoid sowing the seed of degenerate plants. Experience has proved that the mottled or variegated species (*la betterave panachée*) is the least productive, and should always be rejected.

* Review of Dubrunfaut's *Traité complet de l'art de la Distillation*, &c. 2 vols. 8vo. Paris. By E. B. Stephens, Chemical Assistant to the Royal Dublin Society.

† Query—is this the Doctor I. Lettsom of whom we have somewhere heard or read the following tart cockney epigram:

When patients sad to me apply,
I physicks—bleeds and sweats 'em—
If after that they choose to die—
What's that to me—*I Lets 'em.*

ED.

"The beet-root delights in a mixed soil, that is to say, in one that is neither too argillaceous, calcareous, or sandy. It should not be shifting, or liable to excesses of wet or drought. It thrives very well with straw manure, and that of sheep folded on the ground. The seed is generally sown in April, and the harvest is commenced in October or end of September, according to the climate. The soils of the north and the centre of France appear to be more favourable to this culture, than those of the south."

A happy principle of compensation appears to prevail throughout the various climates of our globe: pulpy fruits ripen best in the *tropics*,—the cerelea tribes contain most nutritive matter in the *adjoining temperate* latitudes, while roots and tubers come to perfection in the cold, moist soils of *northern* regions where corn ripens with difficulty, and the "vine and fig tree" are unknown. It is fully admitted, by intelligent travellers, that Great Britain and Ireland possess climates much more congenial to the habitudes of the beet-root than that of France. In the county Kilkenny, at the confluence of the Nore and Barrow, near New Ross, where tide irrigation is available, the mangel wurzel (var. of *Beta Cicla*, with red rind, and streaked flesh red and white,) produces in field drill culture, roots weighing from 19 to 26lbs. each.

Mr. D. continues:—"The crop being pulled, the leaves are cut off at the neck, and left on the ground, while the roots are stored near the spot, so as to be sheltered from the ensuing frosts; in huts for example, or in pits, dug from four to five feet deep, and carefully covered with earth, to the depth of a foot or eighteen inches."

In Ireland the farmer finds it worth his while to pull the outer spreading leaves continually during the progress of the plants, to afford light and air to the roots, as well as space for weeding, horse-hoeing, and *unlanding* the drills. These leaves yield a great weight of sustenance to cattle during the season, in which three pullings are frequently obtained. Milch cows are particularly benefitted by them. The last crop of leaves is still more easily gathered, and never, with us, "left on the ground."

"The roots are taken up from time to time as they are wanted, and submitted to the action of Obedel's rasping machine.* They are by this operation reduced to a finely divided pulp, which is placed on the endless cloth of the cylindrical press (formerly described) to extract the juice; or better still, it is put in sacks of coarse linen, and submitted in a heap to the action of a strong screw press. A hydraulic press is preferable, as being most forcible, but others will give a quantity of juice proportioned to their power. With a good cylindrical press, 70 per. ct. of juice can be obtained from the rough beet-root; but to ensure this product, it is necessary to moisten the residual pulp, and submit it to a second pressure. With the hydraulic and screw presses, a single expression (without moistening and repressing,) gives 65, 70, and even 80 per ct. of juice, according to the power of the machine, and the quality more or less aqueous of the root.

"This juice then, (supposing that it need not be weakened by moistening the pulp,) will mark from 5° to 9° on Baumé's areometre (1035° to 1065° *specific gravity*,) according to the season and the species of beet. It contains, like that of the cane, two sorts of sugar, liquid and concrete: that is to say, a crystallizable substance, and melasses. It contains also water, fermentable and extractive matters, amongst which is always found a peculiar substance that gives the best sugar its acerb taste, and its distinguishing property of stopping the breath. (*attaquer la gorge*) It does not entirely lose this quality after culinary operations,—although it is then but slightly perceptible."

I have tasted specimens of American maple sugar (unrefined) that created a similar sensation when taken into the mouth. It appears to

* Constructed by M. Obedel, of Chaillot, near Paris; value 1200 francs. A truncated cone armed with saw-teeth, rasps the roots as it revolves. It is worked by two horses, and will reduce in 12 hours from 7 to 8000 kilogrammes of beet-roots. (From 7 to 8 tons nearly. A kilogramme is 2,204 lbs. avoirdupois, 1000 kils. are 19 cwt. 2 qrs. 20 lbs.)

depend on a latent aroma, which requires a certain degree of heat and moisture for its development. It is also to be recognized in the peculiar sharp taste of the French spirit from beet-root previous to rectification. There are, however, at present in the Laboratory of the Royal Dublin Society, samples of beet-sugar refined and coarse,—the latter sold as low as six cents for the retail in Paris, quite free from all disagreeable peculiarities.

" The expressed liquid carries its leaven along with it, and speedily undergoes the vinous fermentation.

" On good ground, from 80 to 100,000 pounds weight (38¾ to 48¼ tons) of beet-root can be raised per hectare (2 acres 1 r. 35p. British). In this case it does not stand the farmer in more than from 5 to 6 francs (4*s*. 2*d*. to 5*s*.) for each 1000 lb. (9 cwt. 2 qrs. 15 lbs. avoir.) taking into account all the expenses of culture. 1000 lbs. of beet-root will, in a good year, and with good machinery, give 700 lbs. of juice marking 9° on Baumé, and producing, after being diluted to 5° and fermented, 90 litres (6 gals. 5 pints Imp.) of spirit of good quality, at 19° of Cartier's scale. (935° specific gravity, or British proof.)

" I am not aware that beet-root has ever been cultivated wholly for distillation. There is little of it used by the distiller, except in the shape of melasses produced by the extraction of its sugar. It is found more advantageous to separate all the crystallizable sugar first: the fresh juice is only fermented in seasons unfavourable to its formation, when a profitable quantity cannot be obtained. Distillation then affords a happy means of retrieving the expense incurred. But it may be seen from the facts given above, that distillation alone will afford a profitable return to a farmer who may not have means to establish a sugar manufactory.

" This system of distillation is yet in its infancy:—the consequences are likely to be the production of immense wealth to the nation, and we cannot spread too widely the knowledge that may tend to diffuse its benefits.—Vol 1. p. 90, 95.

In France, M. Dubrunfaut informs us the melasses of beet-root only finds a vent in distillation.

" Its unpleasant taste renders it unsaleable, for it cannot be used like the melasses or treacle of the cane sugar refineries. The only difference between the rough sugars of the beet and the cane, lies in their aroma, for when refined, they are identical."

The weight of the refined beet sugar is something less than that of the cane, bulk for bulk. It is a general opinion that its sweetening power is greater, weight for weight; but that unless very well refined, it will not keep so long.

" The beet melasses carries with it all the flavour of the root, and it happens frequently that it has a strong saline taste from the saltpetre which the beet-roots contain in quantity. Although this melasses appears less sweet to the taste than that of the cane, yet it is much to be preferred for the quantity of spirit it produces. The flavour of the latter it is true, bears little resemblance to that of rum, as it still preserves its peculiar character; but it is agreeable to drink, and can be with certain precautions blended with the rum of the colonies."

As M. Dubrunfaut's philanthropy does not extend to a " diffusion of the benefits" of these precautions, it would appear that the business of adulteration is already a profitable one with our neighbours, though " this system of distillation is yet in its infancy."

The discovery of an effectual plan to prevent a community being poisoned at the pleasure of individuals, is yet a desideratum in civilization: the reactions of law, religion, morality and public opinion are all found powerless to prevent the sophistication of a necessary of life, when its practice puts one per cent. into the " wine doctor's" pocket.

" The following process for inducing a good fermentation in this melasses, I owe to my friend M. Cadet, beet sugar maker and distiller at Dorignies, near Douay. This enlightened manufacturer distills all his own melasses, and has been led by his experiments to a knowledge of the great advantages of operating in the following manner.

" He blends 100 litres, (22 gals. 0¼ pt. Impl.) in a wooden vessel with 100 litres of boiling water. When the entire is well mixed, he covers it up, and leaves it at rest for twelve hours. Then he throws in 200 litres of boiling water, mixes all anew, and leaves it at rest for twelve hours *more*. At this period he sets the fermentation a going, by diluting the mixture with water, either hot or cold; by which means he regulates the temperature at pleasure, and reduces the gravity to 5° or 6° of Baumé, (1035° or 1042° spec. grav.)

" He thus obtains from 100 litres of melasses, 2000 to 2400 litres of well fermented wort, which produce 80 litres, (17 gals. 5 pts. Imp.) of spirit at 19° on Cartier's scale, (935° spr. gr. or British proof.)

" This quantity differs from that stated in various works. M. Chaptal mentions in his excellent treatise on the sugar of beet-roots, published in 1821, that the same quantity of melasses produced him but 15 litres of spirit at 22°, which is equivalent to 18 litres, (3 gals. 7¾ pts.) at 19°. M. Matthew de Dombasle on the contrary assures us that he has constantly drawn 100 litres of spirit at 19°.

" How shall we reconcile such discordant results? I think it can be explained by admitting the probability that M. Chaptal had drained his melasses better, which rendered them less productive in the distillation; and that M. de Dombasle always operated on melasses less despoiled of their sugar, and with clearer views of the nature of the process.

" This mode of proceeding has the advantage of allowing the employment of the hot wash, or spent pot-ale in diluting the melasses, which economises fuel, and accelerates the fermentation. M. Cafler has also frequently found it beneficial to add to his vat, from five to seven kilogrammes, (11 to 15½ lb. Av.) of mixed corn, for 100 litres of melasses. This mixture, composed of one malt and four rye, crushed, renders the fermentation more vigorous and complete.

" I proceed to state an astonishing product of spirit, that M. de Dombasle drew from the melasses of beet-root. It is published in the second edition of an excellent work on beet sugar. Here follow some extracts. They will suffice to make known the peculiarities of his method.

" I suppose," said he, " that the fermentation is set agoing in a vat of 50 hectolitres capacity, (1102 imp. gals.) The dose of flour for the leaven* will be 80 livres, (86½ lb. Av.) and that of sulphuric acid, 10 kilogrammes, (22½ lb. Av.) Over night, a leaven is prepared of 40 livres (43⅛ lb. Av.) of flour, that is to say, half of the entire. In the morning, the vat is one-third filled with water, and a quantity of melasses is thrown in, sufficient to make this water mark 7° on Baumé (spec. grav. 1050°.) They commence by throwing a little boiling water on the melasses, and agitating the mixture briskly. When this is completely blended, (a work of time and labour) more water, (hot or cold) is supplied, till the vat is one-third full of dilute melasses of the above spec. grav. and about 27° R. (92° to 93° Fahr.) 5 kilogrammes of the acid is then thrown in and blended; finally, the leaven is added, and the whole thoroughly mixed and covered up. The fermentation ought to establish itself speedily, and at the end of some hours the liquid should be entirely covered with froth.

" Next day, the second charge is added, a leaven of 20 litres of flour having been prepared over night: the melasses is diluted with hot or cold water in a vessel apart, as before; it is then put into the vat, and luke-warm water is added to keep up the temperature to the same height as that of the first batch. The half of the remaining acid is now added and well stirred into the mass, then the leaven, and the whole is again carefully mixed.

" The day following, the third charge is prepared in the same manner, employing the remainder of the flour and the acid, and keeping the vat carefully covered in the intervals of stirring, &c.

* To make this leaven, rye flour is taken, (not crushed, but ground fine) without separating the bran, and wetted with cold water as if making a griddle cake. Melasses is then added to it, in the proportion of a fourth of the weight of the flour employed; afterwards boiling water is thrown on, little by little, and stirred continually, till it all arrives at the consistency of a semi-fluid, (*d'une bouillie*) and at the temperature of 20° to 25° R. (77° to 88¼° Fahr.) It is now mixed with a little brewer's barm; the vessel is then covered up in a place where the temperature is about 20° R. At the end of an hour, the fermentation ought to be established; if not, it should receive a new quantity of barm. When the leaven is properly prepared it will puff up greatly, and ought to be employed when its ferment is at the highest, and before it becomes sour. Commonly, it is in the best state for use about twelve hours after it has been made. This leaven is much preferable to the bakers' sour leaven cake, (*la pâte aigrie.*) Wheaten flour may be employed instead of rye in its formation, and honey instead of melasses. It has not like barm, the inconvenience of giving a bad taste to the alcoholic product, when employed in excess. Neither is an over-dose to be much feared in an economical view, for it is finally transformed into spirit; but a deficiency is decidedly hurtful, as it impedes the fermentation.

"If this operation is well conducted, the fermentation is not interrupted by the second and third charges; on the contrary, it gains increased energy: the agitation produced is heard at a great distance, and does not diminish till the fermentation approaches its termination, which ought to take place on the second or third day after the last charge.

"It is known that the vat is ready for distillation, when the froth falls, and the movement of fermentation ceases. The liquid then ought to mark 1° to 2° on the areometre, (1006° to 1013° spec. grav.) If it marks above, this indicates that the fermentation is not complete, but there is nothing gained by waiting; from the instant that the signs of the termination of the fermentation appear, all the efforts that can be made to renew it are useless. In general when it does not begin well, it languishes slowly for five or six days, or even beyond. In this case it is advisable to wait its own time of termination, for I have observed, that it becomes impossible to apply a remedy. This bad fermentation is always the result of some mistake committed at the commencement of the operation, supposing that good materials were employed.

"When the vinous fermentation is over, a kind of effervescence goes on in the liquid, which inexperienced persons might take for its continuance, but this is only the commencement of the acetous fermentation, and it is dangerous to mistake it. The character of this second fermentation is very opposite to that of the first: it manifests itself by larger bubbles which burst as they come to the surface with a motion different from that produced by the vinous action. By attentively observing the progress of two or three vats at work, the difference will easily be distinguished. The taste is likewise useful to indicate the progress of the process. The sweetness diminishes as the fermentation advances, and when it is ended, this is replaced by a vinous one, and a remarkable bitterness, observable in every well conducted process, but unaccompanied by any acidulous taste, notwithstanding the presence of sulphuric acid. It is an extraordinary fact, that the wort in which acid is employed, is found after fermentation to be less acidulous than that in which no acid is used. It would appear that the acid is decomposed, or enters into a new combination to form the sour and bitter substance (*amère and acerbe*) which the taste detects.

"When the vinous fermentation is ended, the wort ought to be distilled as speedily as possible.

"By this method M. de Dombasle assures us, that he constantly obtains from melasses, an equal volume of good spirit at 19°. (*British proof.*)

"The employment of sulphuric acid in the enormous dose of 10 kils. for 50 Hects. at 7° seems contradictory to the principles of the vinous fermentation in which the presence of acids is always injurious. But it appears that the sulphuric acid is not in a free state in the liquid, for it forms a bitter compound. It is possible that this combination is the sulphate of lime, in which case the phenomenon may be explained without difficulty. The beet-root juice is always treated with an excess of lime in the preparation of sugar: we know that lime is very soluble in saccharine solutions: we know also that it is injurious to the progress of vinous fermentation. Thus, if the acid combines with the lime, in M. de Dombasle's process, the utility of its employment may be satisfactorily explained. It is to be regretted, that M. de Dombasle has not made some conclusive experiments on this point, as the statements he has already made, evince great care and admirable habits of observation."

The manufacture of spirit from potatoes is also carried on in France upon a large scale; and the following calculations and directions for obtaining it are worthy of notice.

"On an average, a hectare of land yields 440 hectolitres, or 35,200 kilogrammes (34 tons, 12½ cwt. Av.) counting the hectolitre, (22 Gals. 0.264 pints Impl.) at 80 kilogrammes, (176⅓ lb. Av.) It requires for seed, the 16th of this quantity; and there then remains clear produce 33000 kilogrammes, (32 tons, 9⅓ cwt. Av.)

"The quantity of starch in the numerous species of potatoes, varies from 12 to 25 per cent. The remainder is water, and a portion of fibre which varies from four to six per cent. of the weight of the tubercles according to the species. But as this fibre still retains a quantity of starch, we may reckon that the poorest potatoes contain at least 14 to 15 per cent. of their weight of starch, and the richest 27 to 28 per cent.

" The species yielding most starch ought to be chosen for distillation, for it produces most spirit; and it is well known that the expense of manufacture is the same, whether the potato be rich or poor."

M. Dubrunfaut here introduces a table of the quantity of starch in 47 varieties of the potato, analysed by Vanquelin. Unfortunately the names of potatoes are so local and arbitrary, that any attempt at a translation of these, would be of little service. Even with us, one species is known by different appellations in different counties. I select four varieties that I believe are English.

Names.	*External colour.*	*Internal colour.*	*per ct. of Starch.*
Champion.	Pinkish.	Yellow.	15.9
Oxnoble.	Yellowish white.	Yellow.	22.3
Kidney.	Greenish yellow.	Greenish yellow.	16.4
Violet.	Violet.	Yellow.	17.6

Several chemists have analysed potatoes, and published various results. Parmentier obtained between 2 and 3 oz. of starch from a pound Av. of the root; Phillips in his work on cultivated vegetables, states that 2½ oz. can be procured; Einloff obtained from 7680 parts of potatoes, 1153 of starch, and the late Mr. Higgins, (in a series of experiments made in the laboratory of the Royal Dublin Society, May 1822,) found that apple potatoes grated with the skin on, furnished 5 parts of starch from 24 of the root, and that cup potatoes similarly treated, yielded 5 of starch from 32; shewing that 3 parts of apple potatoes are in this respect equivalent to 4 of the cup variety.

" The period most favourable for distillation, is from October (the time of their harvest,) to March, when they begin to bud. Germination has a serious effect on their quality; it diminishes the proportion of starch, and consequently that of the alcohol it would produce. The frosts also which set in during the months that the distillation is in progress, have an injurious effect on the potatoes exposed to their influence. They ought to be preserved in places where the thermometer never descends to Zero, R. (32° Fahr.) Pits are the most proper for this purpose, for the temperature is nearly constant winter and summer, at 10 R. (54° to 55° Fahr.)

" There exist two methods to predispose the potato to ferment, and convert its starch into sugar; one by malted barley, the other by sulphuric acid.

" *Process for inducing fermentation in potatoes by malt.*

" This method, although practised in town distilleries, is more generally adopted in the country, on account of its intimate connection with the fattening of cattle.

" It is composed of three distinct operations: first, boiling; second, crushing; third, maceration. We shall describe these three operations with the variations they are liable to in practice.

" The first means employed in the origin of the distillation of potatoes about the year 1770, consisted in submitting them to the action of boiling water, as in the ordinary mode of cooking; and for this purpose, a boiler was used of from 3 to 4 hectolitres, (66 to 88 Impl. gals.) capacity; but the difficulty of withdrawing the potatoes from the boiler, and the expense of fuel that this process rendered necessary, caused it soon to be abandoned, and replaced by that of boiling by steam.

" This mode produces the same results, and effects a considerable saving of fuel and manipulation."

Here M. Dubrunfaut gives plates and descriptions of the utensils used in France for cooking potatoes. Steam is introduced from a boiler of the ordinary construction, into a wooden tub lined with copper or lead, capable of containing 1024 kilogrammes of potatoes, (19 cwt. 3 qr. 17 lb.) but only charged with 900 kils. (17 cwt. 2 qr. 23lb.) as they swell in the operation. Every hour in this vessel 900 kils. can be boiled, which are

immediately let fall into a washing tub, placed beneath. The fuel consumed amounts to 7 centimes (3½*d.*) of charcoal for each 900 kils. potatoes. The charcoal costs 5 centimes (½*d.*) the kilogramme, (2⅕ lb. Av.) The whole apparatus is so cheap and simple, that he recommends the use of a made of a mixture of clay and horse dung, to stop the chinks where steam might issue.

When the potatoes are boiled, they are passed through cylindrical rollers constructed on the simple principle of our malt-bruisers; M. Dᵗ. recommends that the speed of the rollers should be very unequal; one turning twice as fast as the other. This operation reduces them to the state of coarse pulp, and they are then ready to undergo the process of maceration with malt.

"Suppose that it is wished to operate on a quantity that will yield on maceration 12 hectolitres (264 gals. 3 pts. Imp.) of fermentable pulp. The produce of 400 kilogrammes (7 cwt. 2 qrs. 14 lbs.) of potatoes boiled and crushed, is thrown into a vat of at least 13 hectolitres capacity. To this is added about 25 kil. (55 lbs.) of malt, and a quantity of warm or cold water," (M. Dᵗ. does not say *what* quantity,) "sufficient to establish in the vat a temperature of 30° to 35° R. (100° to 111° Fah.) as in the steeping of corn; the mixture is then worked with a rake, and afterwards left at rest during a quarter or half an hour. Then, whilst one or two men stir the pulp incessantly, boiling water is thrown in, till the temperature of the mass is between 50° and 55° R. (145° and 156° Fah.) It is again left to macerate quietly for two or three hours, after which a final quantity of water is added, sufficient to increase the mixture to the bulk of 12 hectolitres, and bring it to the temperature of 20° to 25° R. (77° to 88½° F.) About a litre (1¾ pt. Imp.) of good barm is then stirred in, and the fermentation begins in a few hours.

"In this maceration, as well as in that of corn, the saccharizing effect of the malt is almost imperceptible in its action. The pulp, on being left at rest, presents on its surface, only a small quantity of a sweetish liquid, indicating that all the starch is not changed into sugar. The cause is to be found in the insufficient action of the steam on the potato during the boiling process; the starch requires to be in complete chemical contact with the malt, ere it can become perfectly liquified and saccharized; but the pulpy envelope, and granular crystalline state of the starch interfere materially to prevent its complete solution and conversion to sugar; such for instance, as takes place in the maceration of rice with malt. This saccharine change, however, is effected in the ensuing fermentation, at a lower heat, but with a loss of time. It keeps pace in fact, with the fermentation throughout its continuance.

"This process, simple as it is, has all the inconveniencies attaching to the distillation of solids (*pâtes*). It has been long a desideratum to remove its imperfections without innovations destructive of its simplicity and economy. The modifications that I now propose, have been submitted this year to the Society of Agriculture at Paris, in the memoir which it has honoured with its prize.

"The proposed improvements can be effected in two methods; one consists in isolating the starch, and then acting on it by malt; in the other, this separation is unnecessary, and the potatoes are operated on as they come from the rasping machine."

As the details of these interesting processes are, like all valuable practical recipes, somewhat minute, they must be reserved for a succeeding number. It is gratifying to observe that scientific men are, of late years, writing in a more exact and workmanlike style:—a mode of communication that those concerned in arts or manufactures can alone fully appreciate the value of. M. Dubrunfaut scarcely allows the most trivial circumstance to escape him that should be noticed for the advantageous pursuance of the processes he treats of. Artists and manufacturers who have had occasion to seek for practical details in works professing to be Encyclopædias in their way, generally end their researches with a settled conviction of the uselessness of seeking in books for information of a nature to aid them in their ordinary avocations.